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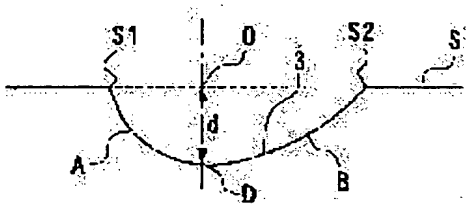
(54) REFLECTOR AND REFLECTIVE LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a reflector having a light diffusion property to suppress undesirable reflection extending over a wide viewing angle range and yet especially brightly viewable in a specified viewing angle range, and a reflective liquid crystal display device using the reflector.
SOLUTION: The reflector is provided with a plurality of recessing parts with a light reflection property formed on a surface of a substrate. The respective recessed parts 3 are formed in such a way that shapes of an inner surface at mutually perpendicularly intersecting first and second vertical sections X, Y consist of a first curve A running from a peripheral part S1 of the recessed part to the deepest point D and a second curve B running from the deepest point D of the recessed part to another peripheral part S2 in succession to the first curve A in the first vertical section X, the average value of the absolute value of an inclined angle of the first curve A based on the surface S of the substrate is larger than the average value of the absolute value of an inclined angle of the second curve B based on the surface S of the substrate and the second vertical section Y is provided with a shallow curve E and deep curves F, G with shorter curvature radii on both sides of the shallow curve E.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] A reflector by which two or more crevices which have light reflex nature were formed in the surface of a base material characterized by providing the following the 1st curve with a configuration of the inside from a periphery of 1 of a crevice to [curve / a crevice of these each has the following 1st longitudinal section and 2nd longitudinal section where each passes through a vertex of a crevice, and / as for said 1st longitudinal section] a vertex While it consists of the 2nd curve from a vertex of a crevice to other peripheries succeeding this 1st curve and the average of an absolute value of a tilt angle to the base material surface of the 1st curve is made larger than the average of an absolute value of a tilt angle to the base material surface of the 2nd curve, said 2nd longitudinal section goes direct with the 1st longitudinal section, and a configuration of that inside is a ** type curve. A ** type curve with radius of curvature are in both sides of a ** type curve, and smaller than a ** type curve
[Claim 2] Said two or more crevices are reflectors according to claim 1 characterized by being formed so that the direction of each 1st longitudinal section and the 2nd longitudinal section may be equal and may carry out orientation in the direction where each 1st curve is single.
[Claim 3] Said 1st curve and 2nd curve are a reflector according to claim 1 or 2 characterized by a tilt angle to the base material surface in a location which touches mutually serving as zero.
[Claim 4] The depth of two or more of said crevices is a reflector given in any of claim 1 to claim 3 characterized by being irregularly formed within the limits of 0.1 micrometers - 3 micrometers they are.
[Claim 5] Said two or more crevices are reflectors given in any of claim 1 to claim 4 characterized by having adjoined irregularly mutually and having been arranged they are.
[Claim 6] A reflective mold liquid crystal display characterized by preparing a reflector of a publication in either of claim 1 to claims 5.
[Claim 7] A reflective mold liquid crystal display according to claim 6 characterized by being prepared so that said reflector has the equal direction of each 1st longitudinal section of two or more of said crevices, and the 2nd longitudinal section, it may be formed so that orientation may be carried out in the direction where each 1st curve is single, the 1st curve [in / in a reflector of a parenthesis / each crevice] may see from an observer and it may be located more nearly up than the 2nd curve.
[Claim 8] A reflector characterized by integral values of a reflection factor of a range differing [whenever / smaller than angle of specular reflection angle-of-reflection] whenever [larger angle-of-reflection / than an integral value of a reflection factor of a range, and an angle of specular reflection] while having a peak of a reflection factor at an angle of specular reflection over the base material surface.
[Claim 9] A reflective mold liquid crystal display characterized by being prepared so that a range may see from an observer and may become the upper part from an angle of specular reflection over the base material surface whenever [angle-of-reflection / to which a reflector according to claim 8 is prepared, and an integral value of said reflection factor of this reflector becomes large].

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the reflector which can be used suitable for the liquid crystal display which makes the light source an extraneous light, a front light, a back light, etc., and the liquid crystal display using this. While having a large angle of visibility by using the reflector which can raise a reflection factor especially in the reflective direction of the range of desired, and its reflector while having a good reflection factor in more detail covering a wide range angle, it is related with the liquid crystal display which has moderate directivity so that brightness sufficient in the main visual field range can be secured.
[0002]
[Description of the Prior Art] As displays, such as a handicap type computer, the liquid crystal display is used widely. Since power consumption is small, the reflective mold liquid crystal display which makes an extraneous light the light source is widely used for these liquid crystal displays. Moreover, in order to compensate an extraneous light, front light preparation ********** is also used widely. These liquid crystal displays reflect in a screen side the extraneous light which carried out incidence from the screen side (observer side), or the light from a front light by the internal reflector, and the user enables it to view the display shown according to the condition of the molecular arrangement of a liquid crystal layer. Moreover, in order to compensate an extraneous light, the liquid crystal display equipped with a back light is also used widely. In this case, in order to enable transparency of the light from a back light as a reflector for reflecting an extraneous light, the reflector of a transflective reflective mold is used.
[0003] this invention persons have added various examination from before about the relation between the shape of surface type of these reflectors (configuration by the side of the screen), and a reflection property. For example, although a very high reflection factor is shown in whenever [corresponding to whenever / incident angle / specific angle-of-reflection] when the reflector made into the mirror plane condition with the even surface is used, the display rectangle where the range of whenever [angle-of-reflection / with a high reflection factor] is very narrow, namely, it is bright in it serves as the narrow reflection property of high directivity. Moreover, the face of the light source or an observer is reflected and there is orientation to reduce visibility. The attempt from which a reflection factor good in a wide range direction is obtained is made by, forming in the reflector surface many the crevices and slots which make a part of spherical surface on the other hand, or preparing random irregularity (Japanese Patent Application No. No. 203637 [nine to], Japanese Patent Application No. No. 197576 [nine to], Japanese Patent Application No. No. 194643 [nine to], etc.). In this case, a bright display rectangle serves as a large reflection property.
[0004] Among this, the reflector as shown in drawing 9 is proposed by Japanese Patent Application No. No. 203637 [nine to] as what established the crevice of a large number which make a part of spherical surface in the reflector surface. It is continuously formed in the surface of the plate-like resin base material 53 (base material for reflectors) which consists of a photopolymer layer prepared on the substrate 52 which consists of glass etc. so that many crevices 54 where that inside makes a part of spherical surface may overlap mutually, and as for the reflector 51 of the gestalt shown in this drawing, the reflective film 55 which consists of thin films, such as aluminum and silver, is formed in it of vacuum evaporationo or printing on it.
[0005] As for the above-mentioned crevice 54, the pitch of the crevice 54 where it adjoins while the depth is formed at random 0.1 thru/or in 3 micrometers is also arranged at random 5 thru/or in 50 micrometers. Moreover, the inside of a crevice 54 is the curved surface which makes a part of single spherical surface respectively, and the tilt angle is set as -18 thru/or the range of +18 degrees.
[0006] In addition, in this specification, "the depth of a crevice" is the distance of the center to center of the crevice which becomes circular [the pitch] when plane view of the distance from the substrate surface of a reflector to the pars basilaris ossis occipitalis of a crevice and the "pitch of an adjoining crevice" is carried out. Moreover, a "tilt angle" is a thing [as opposed to / a thing / the substrate surface of the tangent in the part of the arbitration of the inside of a crevice 54] of an angle in the specific longitudinal section.
[0007] This reflector 51 has the reflection property as shown in the below-mentioned example of a comparison (drawing 6). Drawing 6 is a graph which shows the reflection property curve to which the axis of ordinate was made into the reflection factor (reflectivity), and it made [in / whenever / incident angle / 30 degrees] the horizontal axis as whenever [angle-of-reflection]. In addition, as it is indicated in drawing 10 as whenever [incident angle], they are the normal H stood to the reflector 51 (base material surface), and the angle omega 0 which incident light J makes. Moreover, whenever [angle-of-reflection] is the angle omega which the above-mentioned normal H and the reflected light K make on the plane containing the above-mentioned normal H and incident light J. Moreover, the angle of the specular reflection over the base material surface is an angle to which omega 0 becomes [whenever / incident angle] equal whenever [omega and angle-of-reflection]. As shown in drawing 6 , whenever [angle-of-reflection / which is the angle of specular reflection], focusing on 30 degrees, the range of the reflection property of a reflector 51 is 15 degrees <= omega<=45 degrees, and it has the to some extent good reflection factor.
[0008] [Problem(s) to be Solved by the Invention] As for the conventional reflector 51 mentioned above, a to some extent good reflection factor is obtained covering a comparatively wide range angle by existence of a crevice. However, as shown in drawing 6 , as for the reflection property, the reflection factor is [whenever / angle-of-reflection] low [near the 30 degrees] as a peak of 15 degrees and 45 right and left whenever [angle-of-reflection / which is the angle of specular reflection]. Therefore, although the range where a to some extent good reflection factor is obtained was recognizing existence, it was that by which brightness is spoiled in the direction of specular reflection.

[0009] However, displays built into specific equipment, such as the personal computer and desktop computer of a note type, and a wrist watch, are used in many cases on the conditions which have the angle (whenever [angle-of-reflection]) of the direction of the light source (whenever [incident angle]), and the look of the user who receives the reflected light within the limits of a certain specification. Therefore, it not only obtains a bright display in the large range, but having considered the facilities of use of a user, to increase the reflectivity of a certain specific direction was desired. moreover, the case of a liquid crystal display equipped with a back light — the above — when the large reflector of a bright display rectangle was used, the light from a back light was scattered about too much on the reflector surface, and there was a problem that the light which carries out outgoing radiation to a direction whenever [angle-of-reflection / with the highest utilization factor] will decrease.
[0010] While it is made in order that this invention may solve the above-mentioned problem, and having a good reflection factor covering a wide range angle By using the reflector over which light is not scattered too much when a reflection factor can be raised especially in the direction [direction / of specular reflection / the reflective direction of the range of desired, especially] shifted and a back light is moreover used, and its reflector While having a bright display in the large range, let it be a technical problem to offer the reflective mold liquid crystal display which has moderate directivity to the usual visual field range.
[0011]
[Means for Solving the Problem] in order to solve the aforementioned technical problem, this invention is the reflector in which two or more crevices which have light reflex nature on the surface of a base material were formed, and a crevice of these each offers a reflector characterized by having the following longitudinal section [1st] where each passes through a vertex of a crevice, and the 2nd longitudinal section.
(a) The 1st curve with a configuration of an inside from a periphery of 1 of a crevice to [curve] a vertex, It consists of the 2nd curve from a vertex of a crevice to other peripheries succeeding this 1st curve. the 1st longitudinal section where the average of an absolute value of a tilt angle to the base material surface of the 1st curve is larger than the average of an absolute value of a tilt angle to the base material surface of the 2nd curve, and (b) — the 1st — the longitudinal section — going direct — a configuration of an inside — a ** type curve — The 2nd longitudinal section which is in both sides of a ** type curve, and consists of a ** type curve with radius of curvature smaller than a ** type curve.
Although there is especially no limitation in whether the longitudinal section of which direction is made into the 1st longitudinal section in this specification, it is desirable to see from an observer and to make the longitudinal section of the upper and lower sides or the direction of order into the 1st longitudinal section.
[0012] Since two or more crevices which have light reflex nature on the surface of a base material are formed and these crevices are formed from a curved surface (concave surface), this reflector has optical diffusibility which controls reflected while securing a bright display rectangle widely. Moreover, an inside configuration of these crevices is formed in a curve to which it consists of the 1st curve and the 2nd curve bordering on a vertex, and the average of an absolute value of a tilt angle to the base material surface of the 1st curve becomes larger than the average of an absolute value of a tilt angle to the base material surface of the 2nd curve in the 1st longitudinal section. That is, an inclination of the 1st curve is comparatively steep, an inclination of the 2nd curve is comparatively loose and the 2nd curve is long rather than the 1st curve. For this reason, light reflected in respect of the 2nd curvilinear circumference increases more than light reflected around curvilinear [1st]. That is, it is reflected so that luminous density of the direction of specular reflection over a field of the 2nd curvilinear circumference may become high. Therefore, if the direction of each 1st curve of each crevice is arranged in the specific direction (a single or two or more specific directions), reflectivity of a specific direction can be made to increase as the whole reflector. Furthermore, in the 1st longitudinal section and the 2nd longitudinal section which intersects perpendicularly, since an inside configuration of these crevices is formed so that it may be in both sides of a ** type curve and a ** type curve and may have a ** type curve with small radius of curvature, it can raise a reflection factor of the direction of specular reflection mostly. In addition, a certain thing of a ** type curve is equally desirable on both sides of a ** type curve. Consequently, as a synthetic reflection property in the 1st longitudinal section, while having a peak of a reflection factor at an angle of specular reflection, it becomes what a reflection factor which goes in the direction reflected by field of the 2nd curvilinear circumference increased. That is, it can consider as a reflection property which centralized the reflected light in the specific direction moderately, fully securing the reflected light of the direction of specular reflection.
[0013] In this invention, said two or more crevices have the equal direction of each 1st longitudinal section and the 2nd longitudinal section, and it is desirable to be formed so that orientation may be carried out in the direction where each 1st curve is single. That is, it is desirable to carry out orientation of the first curve of each crevice in the single direction, and to carry out orientation also of the 2nd curve of each crevice in the single direction. It becomes what a reflection factor of a direction reflected in respect of the 2nd curvilinear circumference increased as the whole reflector by this. That is, it can consider as a reflection property on which the reflected light which goes in the specific direction was centralized moderately.
[0014] As for said 1st curve and 2nd curve, in this invention, it is desirable for a tilt angle to the base material surface in a location which touches mutually to serve as zero. Moreover, when a tilt angle of negative and the 2nd curve is made positive for a tilt angle of the 1st curve, as for a tilt angle of the 1st curve, in a location where zero are gradually approached from a negative value side, a tilt angle of the 2nd curve approaches zero gradually from a positive value side, and both touch, it is more desirable for any tilt angle of the 1st curve and the 2nd curve to serve as zero. Thereby, since the whole crevice inside can be formed gently-sloping, it is avoidable that the amount of reflection of the direction of specular reflection decreases.
[0015] As for the depth of two or more of said crevices, it is desirable to be irregularly formed within the limits of 0.1 micrometers - 3 micrometers. Less than 0.1 micrometers of a scattering effect of light are [the depth of a crevice] insufficient. If 3 micrometers is exceeded, thickness of a base material for realizing this depth will become excessive, and a manufacture top will also become inconvenient also in respect of a product. If the depth of two or more crevices is formed irregularly, generating of a moire pattern resulting from interference of light which tends to take place when the depth of a crevice is formed regularly will be prevented, and peak-concentration of the amount of reflected lights in a specific viewing angle will be eased, and the amount change of reflected lights within a field of view will become gently-sloping.
[0016] As for said two or more crevices, it is desirable to adjoin irregularly mutually and to be arranged. if a gap of a crevice is separated, since scattered reflection effect sufficient in a pixel field which plane reflection increased and was restricted since it becomes a plane between crevices will no longer be acquired, as for a crevice, it is desirable to adjoin mutually and to be formed. Moreover, since a moire pattern will occur if a crevice is arranged regularly, as for a crevice, arranging irregularly is desirable.
[0017] This invention offers a reflective mold liquid crystal display with which said one of reflectors was prepared again. It is desirable to be prepared so that said reflector has the equal direction of each 1st longitudinal section of two or more of said crevices and the 2nd longitudinal section, it may be formed so that orientation may be carried out in the direction where each 1st

curve is single, the 1st curve [in / in a reflector of a parenthesis / each crevice] may see from an observer and it may be located especially more nearly up than the 2nd curve. Thus, if it is prepared so that the 1st curve of all crevices may see from an observer and may be located more nearly up than the 2nd curve, outdoor daylight which carries out incidence mainly from the upper part can usually be shifted in the direction of a normal over the base material surface rather than an observer's leg down. Moreover, since outdoor daylight which looks at from an observer and carries out incidence mainly from the upper part carries out incidence to a field of the 2nd curvilinear circumference efficiently, on the whole, the amount of reflected lights increases. Furthermore, the quantity of light of the direction of specular reflection is also fully securable with the reflection from a ** type curve in the 2nd longitudinal section. For this reason, the quantity of light reflected in the direction of an observer's look increases, and a reflective mold liquid crystal display of a bright screen is realized in a view of practical use.

[0018] This invention offers a reflector characterized by integral values of a reflection factor of a range differing [whenever / smaller than angle of specular reflection angle-of-reflection] whenever [larger angle-of-reflection / than an integral value of a reflection factor of a range, and an angle of specular reflection] again while having a peak of a reflection factor at an angle of specular reflection over the base material surface. It can consider as a reflector which can reflect light in the usual concerned angle-of-visibility direction preponderantly, securing the reflected light of the direction of specular reflection according to this invention, when an observer's usual angle of visibility has shifted from the direction of specular reflection.

[0019] While this invention has a peak of a reflection factor at an angle of specular reflection over the base material surface, again A reflector from which an integral value of a reflection factor of a range differs [whenever / smaller than angle of specular reflection angle-of-reflection] whenever [larger angle-of-reflection / than an integral value of a reflection factor of a range and an angle of specular reflection] is prepared. And a reflective mold liquid crystal display characterized by preparing a range whenever [angle-of-reflection / to which an integral value of said reflection factor of this reflector becomes large] so that it may see from an observer and may become the upper part from an angle of specular reflection over the base material surface is offered. According to this invention, outdoor daylight which carries out incidence mainly from the upper part can usually be shifted in the direction of a normal over the base material surface rather than an observer's leg down. For this reason, for example, when it is used as a display of a cellular phone or a notebook computer, the quantity of light reflected in the direction of an observer's look increases, and a reflective mold liquid crystal display of a bright screen is realized in a view of practical use.

[0020]

[Embodiment of the Invention] Next, although the gestalt of operation of this invention is concretely explained using a drawing, the following operation gestalten do not restrict this invention at all. Drawing 1 is drawing showing the reflector of this operation gestalt. As shown in drawing 1 , Crevices 3a, 3b, and 3c and — (generally a crevice 3 is called) which have many light reflex nature adjoin mutually irregularly the surface S of the plate-like base material 2 which consists of aluminum (datum level), and the reflector 1 of this operation gestalt is formed in it.

[0021] The inside configuration of these crevices 3 is shown in drawing 2 - drawing 4 . The cross section of the crevice [in / drawing 2 , and / in drawing 3 / the longitudinal section X] 3 and drawing 4 can be set to the longitudinal section X and the longitudinal section Y which goes direct, and are a cross section about **. [the perspective diagram of a crevice 3] As shown in drawing 3 , the inside configuration in the longitudinal section X of a crevice 3 consists of the 2nd curve B from the vertex D of a crevice to other peripheries S2 succeeding the 1st curve A from the periphery S1 of 1 of a crevice to Vertex D, and this 1st curve A. In drawing 3 , the tilt angle [on Vertex D and as opposed to the base material surface S in the 2nd curve B of the 1st curve A of ** and an upward slant to the right both] became zero, and it is connected gently-sloping mutually. [lower right] The tilt angle to the base material surface S of the 1st curve A is more sudden than the tilt angle of the 2nd curve B, and Vertex D is located in the location [center / O / of a crevice 3] shifted in the x directions. That is, the average of the absolute value of the tilt angle to the base material surface S of the 1st curve A is larger than the average of the absolute value of the tilt angle to the base material surface S of the 2nd curve B. The average of the absolute value of the tilt angle to Crevices 3a, 3b, and 3c and the base material surface S of the 1st curve A in — differs in 2-90 degrees irregularly. Moreover, the average of the absolute value of the tilt angle to Crevices 3a, 3b, and 3c and the base material surface S of the 2nd curve B in — differs in 1-89 degrees irregularly.

[0022] On the other hand, as shown in drawing 4 , as for the inside configuration in the longitudinal section Y of a crevice 3, right and left have become mostly to the center O of a crevice 3, and, in the vertex D circumference, radius of curvature serves as large the ** type curve E near a straight line. Moreover, right and left of the ** type curve E serve as the ** type curves F and G with large radius of curvature. The absolute value of the tilt angle to Crevices 3a, 3b, and 3c and the base material surface S of the ** type curve E in — is 10 degrees or less in general. Moreover, although the absolute value of the tilt angle to the base material surface S of Crevices 3a, 3b, and 3c and the ** type curves F and G in — also varies irregularly, it is 2-90 degrees, for example. Moreover, the distance on Vertex D and the surface S of a base material forms depth d of a crevice 3, and this depth d differs within the limits of 0.1 micrometers - 3 micrometers irregularly about Crevices 3a, 3b, and 3c and —, respectively.

[0023] In this operation gestalt, each cross section X in Crevices 3a, 3b, and 3c and — is each in the same direction. Moreover, each cross section Y in Crevices 3a, 3b, and 3c and — is each in the same direction similarly. Furthermore, it is formed so that each 1st curve A may carry out orientation in the single direction. That is, it is formed so that the direction of x shown in drawing 2 and drawing 3 may become the same in any crevice.

[0024] In the reflector 1 of this operation gestalt, since it is formed so that each 1st curve A may carry out orientation in the single direction, the reflection property is the thing [direction / of the specular reflection over the base material surface S] shifted, as shown in drawing 5 . That is, as shown in drawing 5 , the reflected light K to the incident light J from the slanting upper part of x directions is what the bright display rectangle shifted in the direction shifted in the direction H over the base material surface S from the direction K0 of specular reflection. Furthermore, since it is formed so that it may be in the both sides of the ** type curve E with large radius of curvature, and the ** type curve E in the 1st longitudinal section X and the 2nd longitudinal section Y which intersects perpendicularly, respectively and may have the ** type curves F and G with small radius of curvature, the reflection factor of the direction of the specular reflection over the base material surface S can be raised.

[0025] Consequently, as a synthetic reflection property in the 1st longitudinal section, as shown in drawing 6 , while having the peak of a reflection factor at the angle of specular reflection, it becomes what the reflection factor of the direction reflected by the field of the 2nd curvilinear B circumference increased. That is, it can consider as the reflection property which centralized the reflected light in the specific direction moderately, fully securing the reflected light of the direction of specular reflection. That is, drawing 6 irradiates outdoor daylight at 30 degrees of incident angles at the screen of the reflector 1 of this operation gestalt, and shows the relation between the light-receiving angle (theta**) when shaking a light-receiving angle from a perpendicular location (0 degree) to 60 degrees focusing on 30 degrees which is the direction of the specular reflection over the

screen (base material surface), and brightness (reflection factor). Drawing 6 also showed the relation between the light-receiving angle of the reflective mold liquid crystal display using the reflector which has the spherical-surface-like crevice used from the former as an example of a comparison, and a reflection factor. While having the peak of a reflection factor with the reflector 1 of this operation gestalt to the example of a comparison having shown the almost equal reflection factor by within the limits from about 15 degrees of carrier optic angles to about 45 degrees at 30 degrees which is the angle of the specular reflection over the base material surface S, the integral value of the reflection factor of a range is [whenever / smaller than angle of 30 degrees of specular reflection angle-of-reflection] larger than the integral value of the reflection factor of a range whenever [larger angle-of-reflection], so that clearly from drawing 6 That is, sufficient brightness can be attained in the visual field before and behind the angle of 20 degrees, securing the brightness of the direction of specular reflection.

[0026] Especially the manufacture method of a reflector 1 can be manufactured as follows, for example, although it does not limit. First, a stamping stroke is changed irregularly, and a stamping gap is changed irregularly, producing the punch (dotting punch implement) which has the tip configuration where the configuration of said crevice was changed into the convex, making the tip of this punch counter an aluminum base material, and keeping constant the relative direction of orientation over the aluminum base material of punch, and the whole predetermined field surface of an aluminum base material is stamped. A stamping stroke is adjusted so that the depth of a crevice may go into a predetermined range. A stamping gap is adjusted so that a moire pattern may not occur.

[0027] Drawing 7 is the cross section showing the lamination of the reflective mold liquid crystal display 100 incorporating the reflector 1 of this operation gestalt. In drawing 7 , as for this reflective mold liquid crystal display 100, it has come to carry out opposite arrangement of the display side substrate 20 of light transmission nature, and the reflection side substrate 10 of light reflex nature on both sides of the liquid crystal layer 30. The lateral surface of the display side substrate 20 is the screen, and the reflector 1 is included in the reflection side substrate 10.

[0028] The laminating of the transparent electrode 16 with which the reflection side substrate 10 becomes order from a glass substrate 11, a reflector 1, the transparence mediation layer 13, the color filter layer 14, the transparence flattening layer 15, an ITO (Indium Tin Oxide) film, or a Nesa membrane from a lower layer, and the orientation layer 17 is carried out. Moreover, it has come to carry out the laminating of the transparent electrode 23 with which the display side substrate 20 by which opposite arrangement is carried out on both sides of the liquid crystal layer 30 at a screen side becomes order from the orientation layer 21, an insulating layer 22, an ITO film, or a Nesa membrane from the liquid crystal layer 30 side, a glass substrate 24, and the optical modulation layers (a polarizing plate, phase contrast board, etc.) 25. Moreover, the transparent electrode 16 whose liquid crystal layer 30 is pinched, and the transparent electrode 23 constitute the liquid crystal equipment of the simple matrix type with which it is formed in the shape of [which intersects perpendicularly mutually] a stripe, and the intersection field serves as a pixel.

[0029] In this reflective mold liquid crystal display 100, it is equipped with the reflector 1 so that each crevices 3a, 3b, and 3c and the 1st curve A of — may consist of the 2nd loose curve B of an inclination the x direction side. And the display of an alphabetic character etc. is made by making these x directions into the bottom.

[0030] Drawing 8 is explanatory drawing showing the busy condition of this liquid crystal display 100. In addition, in drawing 8 , the 1st curve A and the 2nd curve B of the expedient top of explanation and the reflective mold liquid crystal display 100 are illustrated, and illustration of other configuration members is omitted. Such a reflective mold liquid crystal display 100 turns x directions up, and is built into a cellular phone, a notebook computer, etc. In this case, the reflective mold liquid crystal display 100 is usually aslant installed or held to a horizontal plane by making x directions into the slanting upper part, as shown in drawing 8 . That is, in the time of use, it is prepared so that the 1st curve A in each crevice may see from an observer and may be located more nearly up than the 2nd curve B. And usually as for an observer, a level twist also looks down on this reflective mold liquid crystal display 100 from the slanting upper part. In this case, since it is reflected mainly in respect of the 2nd curvilinear B circumference, as explained in drawing 5 , in the direction at an observer's feet, it is hard to reflect, the reflected light K of the outdoor daylight (incident light J) which carries out incidence mainly from the upper part becomes, and it comes to reflect it in the direction of [above the direction K0 of specular reflection] preponderantly. For this reason, the usual observation range of an observer and a bright display rectangle are in agreement, and a bright display can be realized practically.

[0031] Although the reflective mold liquid crystal display of the operation gestalt shown in drawing 7 formed the reflector 1 as layer with an another transparent electrode 16, if transparent electrode 16 the very thing is formed by the reflector 1 and a transparent electrode 16 is formed in the location of the reflector 1 of drawing 6 , a transparent electrode can serve as a reflector and the lamination of a reflective mold liquid crystal display will be simplified.

[0032] Moreover, if said lighting panel is turned on when forming said reflector with a half-transparency half reflexibility base material like a half mirror, and arranging the lighting panel at the back of a liquid crystal panel, and it becomes a reflective mold when outdoor daylight is bright and outdoor daylight becomes dark, the half-transparency half reflective mold liquid crystal display which can be used as a transparency mold will be obtained. This transflective reflective mold liquid crystal display is also contained in this invention.

[0033] Moreover, if a front light is prepared in the screen side of said display side substrate 20, when outdoor daylight is bright, only outdoor daylight is used, and when outdoor daylight becomes dark, the liquid crystal display of a front light mold which turns on said front light will be obtained. This front light type of liquid crystal display is also contained in this invention.

[0034] Especially the liquid crystal drive method of this invention is not limited, and can be applied like the active-matrix mold which used the thin film transistor or thin-film diode other than said simple matrix type, or a segmental die. Each of these liquid crystal displays is contained in this invention.

[0035]

[Effect of the Invention] Two or more crevices where the reflector of this invention has light reflex nature on the surface of a base material are formed. the crevice of these each The configuration of the inside in the 1st longitudinal section and the 2nd longitudinal section which go direct mutually sets to the 1st longitudinal section. The 1st curve from the periphery of 1 of a crevice to a vertex and this 1st curve are followed. Consist of the 2nd curve from the vertex of a crevice to other peripheries, and the average of the absolute value of the tilt angle to the base material surface of the 1st curve It is larger than the average of the absolute value of the tilt angle to the base material surface of the 2nd curve, and sets to the 2nd longitudinal section. Since it is in the both sides of a ** type curve and a ** type curve and is formed from the ** type curve with radius of curvature smaller than a ** type curve, incident light is reflected irregularly, and while having the optical diffusibility which controls reflected in the large viewing-angle range, the amount of reflected lights in the usual viewing-angle range of an observer can be enlarged. When observing the screen from a specific viewing angle, the reflective mold liquid crystal display of this invention using

the reflector of this invention turns into a reflective mold liquid crystal display which looks bright especially and with which visibility has been improved, while reflected is controlled in the large viewing-angle range.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The perspective diagram showing the portion of the reflector of an operation gestalt.
[Drawing 2] The perspective diagram showing one crevice of an operation gestalt.
[Drawing 3] The cross section in said 1st longitudinal section of a crevice.
[Drawing 4] The cross section in said 2nd longitudinal section of a crevice.
[Drawing 5] Explanatory drawing of the reflection property of the reflector of an operation gestalt.
[Drawing 6] The graph which shows the relation between a light-receiving angle and a reflection factor.
[Drawing 7] The cross section showing the lamination of the reflective mold liquid crystal display of an operation gestalt.
[Drawing 8] Explanatory drawing of the busy condition of the reflective mold liquid crystal display of an operation gestalt.
[Drawing 9] The perspective diagram showing the conventional reflector.
[Drawing 10] Explanatory drawing of an incident angle and angle of reflection.
[Description of Notations]
1: Reflector
2: Base material 3
3a, 3b, 3c: Crevice
10: Reflection side substrate
A: The 1st curve
B: The 2nd curve
C: ** type curve
F, G: ** type curve

[Translation done.]